

Source Selection for VSOP: Lessons Learned from the TDRSS Space VLBI Demonstrations

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The '1'1)1{SS Space VLBI demonstrations performed in the late 1980s provided valuable insight into the capability of Space VLBI for detecting compact radio sources, although the sparse (u,v) coverage enabled only limited inferences about source properties. Fringe detection thresholds in the '1'1)1{SS experiments were on the order of 0.3 Jy at 2.3 GHz and 1.3 Jy at 15 GHz. Candidates for these experiments were selected based on compact source strength, the existence of flat or inverted spectra, and high fringe visibilities measured in transcontinental VLBI surveys at 2.3 and 8.4 GHz. In the restricted declination range accessible to '1'1)1{DRSS, 23 out of 24 sources were detected at 2.3 GHz on space-ground baselines as long as 2.1 Earth diameters; 11 of 22 sources were detected in the much less sensitive 15-GHz observations (Linfield et al., 1989, Ap.J., 336, 1105; Linfield et al., 1990, Ap.J., 358, 350). Measured source brightness temperatures were 1.4×10^{12} K at both frequencies.

The projected baseline lengths and the observing frequencies for VSOP will be comparable to those in the '1'1)1{SS demonstrations. As with '1'1)1{SS, the expected sensitivity of the VSOP radio telescope will limit observations to fairly strong sources. For example, on a baseline to a single 25-m VLBA telescope, the minimum detectable brightness temperature for a 1-Jy compact component will be on the order of 10¹¹ K at 1.6 and 5 GHz, and 10^{11.5} K at 22 GHz. Therefore, selection of the most suitable candidate sources for VSOP observations should be possible using criteria similar to those employed in the '1'1)1{SS demonstrations.

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